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Diatom (Bacillariophyta) Flora of Albanian Coastal Wetlands Taxonomy and Ecology: A Review

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The Albanian coast still features interesting and important lagoons and other wetlands, characterised by high biodiversity. The present paper focuses on their diatom flora: taxonomy and ecology. The cheklist of hitherto identified taxa contains about 430 taxa observed in different coastal habitats, e.g., Butrinti, Karavasta, and Lezha. From the diatom structure, an evaluation of the ecological values and the trophic state of some coastal ecosystems can be made. In some of these (e.g., Butrinti), diatom and peridinophyte blooms, formed by potentially toxic species (e.g., *Pseudonitzschia seriata*, *Prorocentrum micans*, and *P. minimum*), were observed during the summer. The blooms were probably the result of the limited water exchange and were enhanced by other environmental factors (i.e., temperature, nutrients).

Studies on the ecology and taxonomy of brackish water diatoms should always be interrelated with and supported by integrated environmental programs. In the existing programs dealing with coastal wetlands, the ecological aspect is always manifestly important. However, the ecological goals cannot be satisfactorily achieved if the need for a basic taxonomic approach is neglected, which is often the case. Recently, numerous geobotanical and ecological studies of the diatom flora of lagoons from regions with different climatic conditions have been made (e.g., Miho 1994; Danielidis 1980; Witkowski 1991; Bak et al. 2001; Trobajo 2003). Similarly to other Mediterranean countries, Albania features a high diversity of species and sensitive habitats, which are rather poorly known and remain exposed to a significant impact of human activity (NEA/AKM 1999).

Biological zonation and/or the natural trophic/saprobic status of coastal lagoons can be established by studying the taxonomy and ecology of the diatom assemblages present (Miho 1994; Miho and Mitrushi 1999; Bak et al. 2001; Silvestre et al. 2002; Trobajo 2003). Such studies provide a substantial aid in exploration of biodiversity and functioning of food webs in coastal areas (Essink, 2003) and prove useful in assuring and strengthening further efforts towards their protection, restoration and sustainable use.

Publications on microscopic algae in Albania began with sporadic taxonomic surveys by foreign algologists, e.g., Forti (1902) in Shkodra Lake, Beck (1904) in Prespa Lake, Protic (1907) in brackish water habitats of Vlora, Krenner (1926) in the Drini River and Uherkovic (1963) in Shkumbini and some other rivers. Albanian studies were initiated in the 1980s. During 1987–1991, Miho (1994, 1996) surveyed the phytoplankton in Butrinti lagoon. These were expanded by research on the relationship between microalgae species composition and the trophic status of the habitats studied (e.g., Ohrid and Prespa lakes, Shkumbini and other rivers, Lezha and Vlora lagoons, glacial lakes, e.g., Miho1998a, 1998b; Miho and Mitrushi 1999; Miho and Dedej 1999; Miho and Lange-Bertalot 2001, 2003; Miho, Cake, and Carcani [in press]; Cullaj et al. 2003). Dedej (1994, 1995) provided also some preliminary data on the phytoplankton of the Durresi and Karavasta regions. Recently, Rakaj (2002), Rakaj and Kashta (1999) and Rakaj et al. (2000, 2001) have reviewed the Lake Shkodra phytoplankton. Some other publications, i.e., those by Hustedt (1945), Jurilj (1954) and Vilicic et al. (2002) are important taxonomic contributions, particularly with respect to diatoms.

The present paper reviews the diatom flora of the Albanian coastal wetlands, and is an example of how taxonomy and ecology can be mutually supportive. In addition to the floristic composition, information on the ecological and trophic status of various coastal wetlands is provided.

General Background

Albania is a small country that extends between a high mountain range and the Adriatic Sea, bordering Montenegro and Kosovo to the north, the Republic of Macedonia to the east and Greece to the south (Fig. 1). The country features large wetland areas surrounded by evergreen hills along the Adriatic coast; in addition, almost two-thirds of the country's surface area is covered by high mountain ranges (up to 2700 m) separated by valleys. The Albanian coast is about 427 km long, 273 km along the Adriatic Sea and 154 km along the Ionian Sea (Kabo 1990–91).

The low accumulative Adriatic coast extends from the Buna/Bojana delta to Vlora Bay (Fig. 1) and is characterised by the presence of fluvial deltas, inlets and lagoons, beaches, coastal sand bars, rocky promontories, submerged caves, sandy dunes and extended inland bays. Estuaries of major rivers intersect the coast: Drini, Buna, Mati, Ishmi, Shkumbini, Semani, and Vjosa that run westwards from the country's interior (Kabo 1990–91). The rivers are major water conduits not only for Albania, but also for the whole eastern Adriatic Sea. In their eastern sections they are torrential and erosive, whereas in the Western Coastal Plain they generally form wide meandering beds.

In contrast, the Ionian coast is steep, mountainous and rocky, intersected only by a few small rivers, such as the Bistrica and Pavlla. The coast also features some small wetlands and islets. The region is characteristic in its high diversity of habitats and species. In addition, it supports active aquaculture and fisheries, while urbanisation and industrial activities are limited. Butrinti, a wetland complex, unique in its biodiversity and aquaculture, is situated in the southern part (Fig. 1).

Coastal Wetlands and their Ecological Values

Despite reclamation for agricultural purposes during the past decades, Albania still has about 109 km^2 of coastal wetlands or lagoons. Kabo (1990–91) described the main hydrological characteristics of Albanian lagoons, and the ecology has been reviewed by Peja et al. (1996). The most important coastal wetlands are Karavasta, Narta, Lezha, and Patoku on the Adriatic, and Butrinti on the Ionian coast (Fig. 1). The lagoons extend along the coastline and are separated from the sea by rather narrow sandy spits, which continuously change in size and shape. They are generally characterised by brackish waters, being connected with the sea through one or more channels.

Generally, wetlands display a large number of biotopes with enormous diversity of aquatic flora and fauna. Moreover, they are important especially for wintering of migratory birds (more than 70 species; NEA/AKM 1999). Some of these wetlands, e.g., Narta and Lezha, are partly protected. Regarding richness in habitats, flora and fauna (especially globally threatened water birds, i.e., the Dalmatian pelican) Karavasta and Divjaka National Park area have recently been designated Ramsar sites (Ramsar 1971, convention on wetlands [see *<http://www.ramsar.org/*

profiles_albania.htm>]). Wetland areas have a very substantial economic potential for tourism, as breeding and refuge habitats for fish, and as valuable aquaculture sites. According to Peja et al. (1996), up to 6,000 kg of fish has been annually harvested during periods of high productivity.

Karavasta lagoon (surface area 43 km²), situated between the Semani and Shkumbini deltas, is the largest of Albania. It is connected with the sea through three short channels. Divjaka forest (12 km²) spreads out in the northwest of the lagoon (Kabo, 1990–91). It is a typically dune forest, bordered by brackish or freshwater, where pines (*Pinus halepensis* and *P. pinea*) grow up in old dunes, mixed with shrubs, grasses or reeds near lagoon shores. The lagoon system of Lezha is 10–15 km long and 3 km wide with a total area of about 22 km², 11.6 km² consisting of lagoons (Ceka, Merxhani, and Kenalla), 2 km² forests (Vaina and Kune) and 7 km² of wetlands. Their origin is related to deltaic processes of the Drini River. Narta, situated in the southern part of the Vjosa delta, covers 42 km² and connects with the sea via two channels. All these lagoons are shallow and fluvial in origin. Butrinti (16 km²) is one of the most interesting lagoons of tectonic origin. Due to its relatively great depth (averaging 14 m), its water column is permanently stratified. Its bottom is characterized by anaerobic decomposition. However, during the past few decades, the lagoon has been used intensively in aquaculture of mussels (*Mytilus galloprovincialis*) (up to 2,000 to 4,500 ton gross product/year).

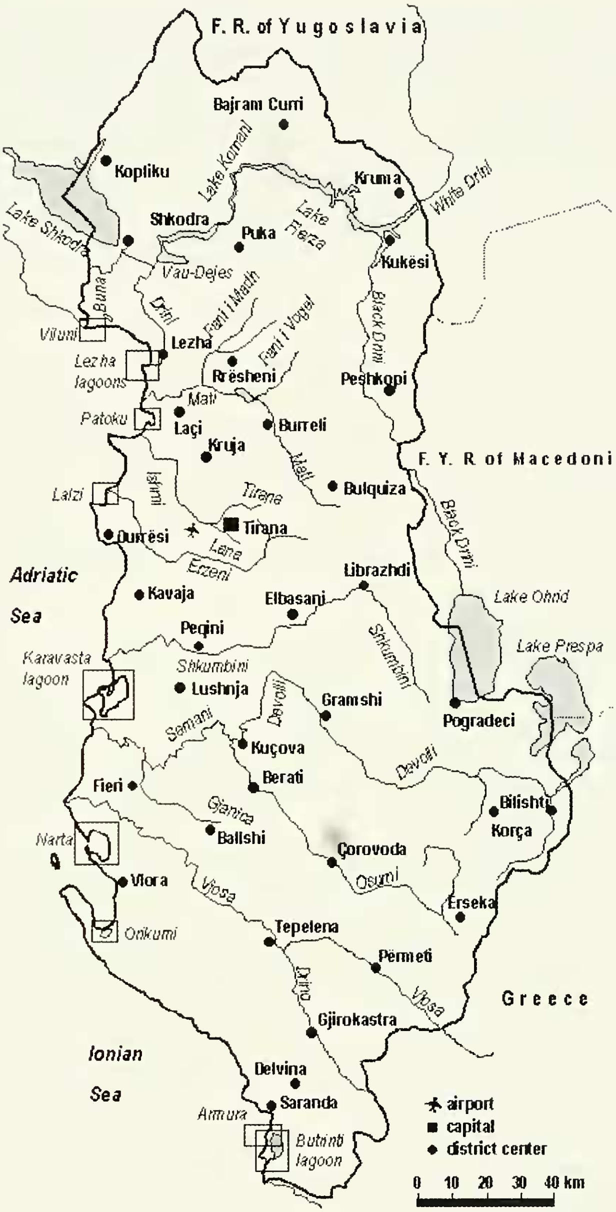

FIGURE 1: Location of Albanian coastal wetlands.

The wetlands are, however, very sensitive ecosystems that were under strong impact in the past due to the extensive agricultural reclamation and unsustainable industry. At present, the western lowland supports densely populated industrial centres, intensive agriculture and tourism.

Therefore, some riverine waters (i.e., of Ishmi, Tirana, Lana, Gjanica, etc.) are heavily loaded with urban and industrial sewage discharged directly to rivers that transport this load to the sea. Moreover, high levels of heavy metals have been found in Vlora and Durresi bays, Mati delta, etc. Petroleum industry in Fieri and Vlora also result in an adverse ecological impact on the Semani and Vjosa deltas and their related lagoons. Coastal dune forests are under pressure of touristic development. Also, the high rate of erosion caused by excessive woodcutting, overgrazing or firing in realtive shallow water basins, further increases the amount of suspended matter transported to the sea by the rivers (Cullaj et al. 2003; UNEP 2000).

Diatoms: Taxonomic Approach

The survey of recent publications on Albanian waters, including the lakes on its borders, shows the number of diatom species to exceed 1 200. The most interesting area seems to be Lake Ohrid with about 550 species (Miho and Lange-Bertalot 2003), of which more than 100 are endemic or rarely occurring species. In their 1999–2000 study of Albanian freshwater diatom flora, Miho and Lange-Bertalot identified 900 taxa, including some whose distribution is poorly known (Miho and Lange-Bertalot 2001, 2003). Some of these (*Aneumastus albanicus*, *A. rosettae*, *A. humboltianus, Navicula pseudoppugnata, N. parahasta N. hastatula*, and *Cymbopleura albanica, C. lura* and *C. lata* var. *lura)* have recently been described as new to science in Lange-Bertalot (2001) and Krammer (2003), respectively.

Altogether, more than 430 diatom taxa were identified in the brackish water coastal wetlands, either published or presented here for the first time. Of this group, 365 taxa are pennate and 65 are centrics. More than 160 taxa were found in Butrinti and about 115 in Karavasta, representing two ecosystems with the highest number of taxa. The checklist of the species identified is given in table 1. Despite the efforts to avoid synonyms or changed names of longer established taxa, some *taxa* might be recorded here twice under different names and some identifications may not be correct. Selected taxa (13 taxa in 25 figures), either the most abundant ones or those taxonomically interesting, are illustrated in Plates I and II. The data from this compilation represent the first step to shed light on the diatom flora of this Mediterranean area, hitherto unknown. About 240 taxa have already been published, whereas about 110 were not recorded before in this area; therefore, about 80 taxa have not been observed in Albanian samples examined previously.

Vilicic et al. (2002) have already published a checklist of phytoplankton taxa in the Eastern Adriatic Sea, referring to the Croatian coast. In all, 888 taxa were reported, of which 518 were diatoms (330 pennates and 174 centrics). The data refer to naturally eutrophic areas (bays, estuaries), harbours, etc. However, only 118 taxa were also included in the Albanian checklist reported here. Probably, the difference in comparison with the Croatian checklist could be due to the fact that many of the Albanian samples were of periphyton. In addition, the various habitats differ in relation to their ecology.

Protic (1907) provided the first data on some brackish habitats from the Albanian coast (in Orikumi and Narta: Vlora region). His list included 196 species, 107 of which were diatoms. When dealing with phytoplankton of Butrinti, Miho (1994, 1996) reported 90 species, 60 of which were diatoms. This was the first ecological approach to study an important habitat, at that time intensively used for aquaculture. The diatom genus *Nitzschia* was represented by the highest number of species; however, centrics, especially *Chaetoceros* spp. and *Cyclotella* aff. *choctawhatcheeana,* were the most abundant. The difficulty in their identification was the principal taxonomic problem. As a matter of fact, more than 40 taxa in Table 1 are not fully determined. Other abundant species included *Pseudonitzschia seriata*, *Nitzschia capitellata* and *Thalassionema nitzschioides*. They were accompanied by peridinophytes, e.g., *Prorocentrum micans*, *P. minimum*, *Scrippsiella* sp., *Ceratium fusus*, *C. pulchellum*. In the three Lezha lagoons (Ceka, Merxhani, Kenalla), about 90 phytoplankton species were recorded in July 1996 (Miho and Mitrushi 1999). A relatively high diversity was observed in Merxhani where *Chaetoceros* spp., *Amphora holsatica*, *Nitzschia sigma*, *Entomoneis paludosa*, *Cerataulus turgidus*, *Melosira nummuloides*, *Grammatophora oceanica*, *Pleurosigma angulatum* and *Striatella unipunctata* were observed as abundant species. In Ceka, an algal bloom was observed, dominated by *Nitzschia reversa*, *Peridinium* spp., *Gonyaulax monacantha*, and *Prorocentrum minimum*. Kenalla, a relatively deep pond close to the shallow lagoon of Merxhani, supported large populations of the centric diatom *Chaetoceros muelleri*, associated with abundant filamentous blue-green algae, e.g., *Anabaenopsis circularis*, *Oscillatoria* sp., and a small peridinophyte *Gymnodinium* sp.

Occasional surveys were also carried out in other Albanian wetlands, i.e., Saranda, Karavasta, Narta, Patoku, Viluni and Durresi (Lalzi) (Miho 1998b). In Karavasta, 65 diatom species were identified. In this locality, again, pennates represented by the genera *Fragilaria* and *Cocconeis* prevailed. In 1992–93, more than 75 diatoms were identified in the Orikumi wetland, where pennates also dominated. In a recent assessment of different habitats of Butrinti, Armura and Saranda Harbour, spanning the period of 1998–2000, over 200 epiphytic diatoms were identified. These included 28 centric species, represented by *Cyclotella* (6 species), *Actinocyclus* (5), and *Chaetoceros* (4), as well as 178 pennates, including, e.g., *Nitzschia* (25 species), *Mastogloia* (20), *Amphora* (14) and *Navicula* (12). The most abundant taxa included *Cyclotella* cf. *choctawhatcheeana*, *Achnanthes brevipes*, *Amphora* cf. *tomiakae*, *A. coffeaeformis*, *Bacillaria paxillifer*, *Cocconeis placentula*, *C. scutellum*, *Staurosira construens*, *Mastogloia crucicula*, *Nitzschia coarctata*, *N. constricta*, *Pleurosigma formosum* and *Thalassionema nitzschioides*.

Certain species, interesting either from an ecological or taxonomical point of view, are presented below. Some of them represent the dominant organism, whereas others are poorly known.

Cyclotella aff. *choctawhatcheeana* Prasad (Plate 1: Figs. 1–9) was abundant in the phytoplankton of Butrinti (Miho 1994) where it was responsible for an autumn bloom. The species occurred as solitary cells or colonies and was present in the water column throughout the growing season. *C.* aff. *choctawhatcheeana* occurred in combination with various *Chaetoceros* species. In other Albanian lagoons (Orikumi, Karavasta) the distribution was scarce and represented by single cells only. Albanian specimens belong to the *Cyclotella caspia* group and are closely related to *C. choctawhatcheeana* Prasad; however, some characters differ from the descriptions given by Prasad (1991), Wendker (1991), and Hakansson et al. (1993). Unlike *C. choctawhatcheeana*, the Albanian specimens possess 1–3 fultoportulae in the middle; the transapical striae were radiate but finer, about 30–40/10µm, and measured 5–15 µm.

Chaetoceros spp. (Plate 1: Figs. 10–14): the species belonging to the genus *Chaetoceros* occurred abundantly in the phytoplankton of the lagoons, especially in Butrinti, Orikumi, and Merxhani. However, due to their very fine structure, it was not easy to identify the most common species. Nevertheless, as shown by Miho (1994), *Ch. wighamii* Brightwell seems to be the most abundant, characterised by very small colony-forming cells with very fine setae.

Actinocyclus cf. *subtilis* (Gregory) Ralfs (Plate 2: Fig. 2) was found in brackish and almost marine waters, e.g., Butrinti and Armura Bay (Saranda). Based on their overall morphology, our specimens resembled *A. subtilis* (Gregory) Ralfs. However, they differed from this in having a generally larger valve diameter (exceeding 68 µm) and denser areolation of the striae (more than 16 puncta/10 µm). The taxon appears to have morphologically distinct valves; according to the species description by Witkowski et al. (2000), *A. subtilis* valve diameter is smaller and the striae possess a coarser areolation (about 12/10 µm).

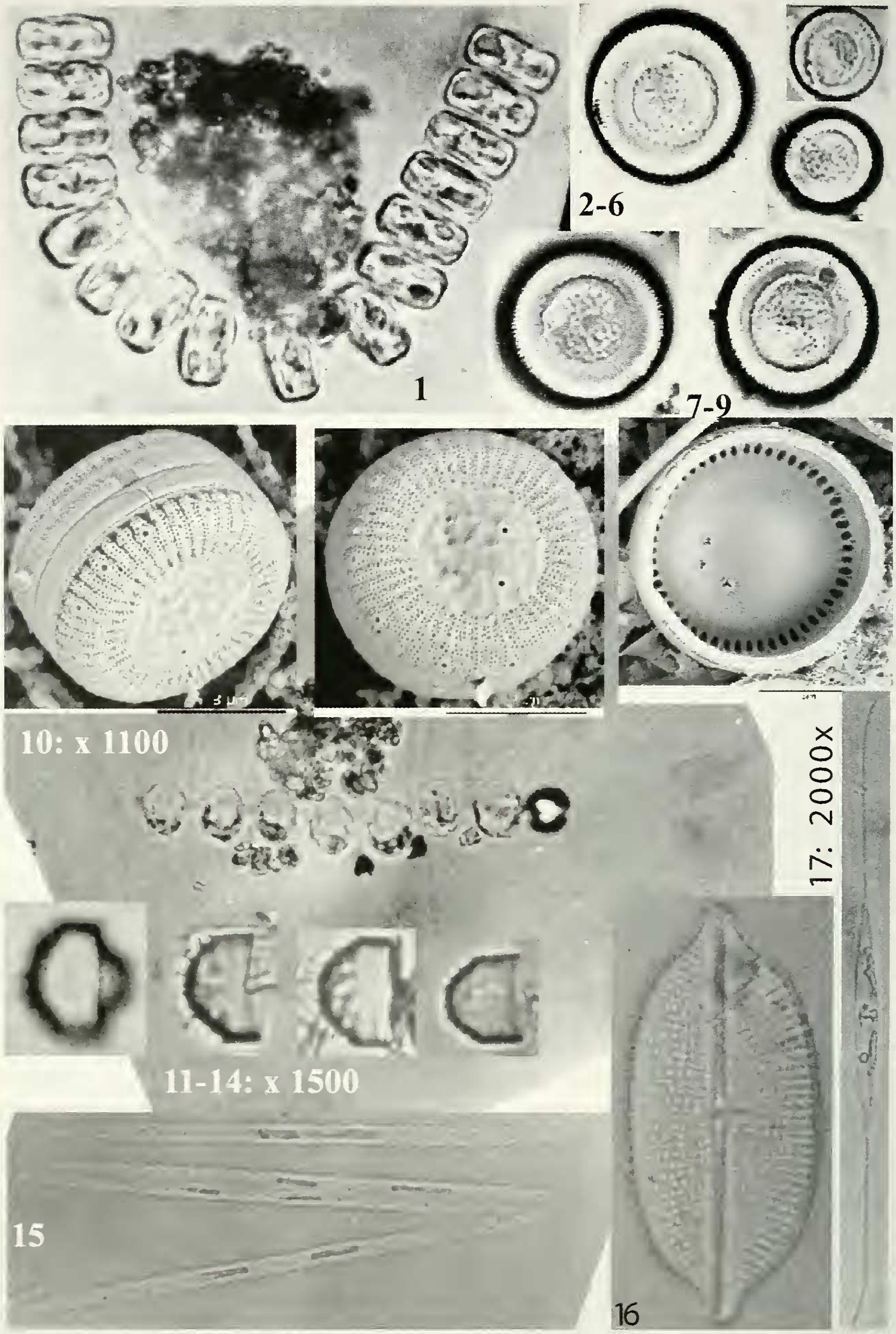

PLATE I. Figs. 1–9: *Cyclotella aff. choctawhatcheeana* Prasad; Figs. 10–14: *Chaetoceros* sp. diverse (cf. *Ch. wighamii* Brightwell); Fig. 7–9, SEM, bar = 3 µm); Fig. 15: *Pseudonitzschia seriata* Cleve; Fig. 16: *Navicula* cf. *besarensis* Giffen; Fig. 17: *Nitzschia reversa* W. Smith. (Figs. 1–6, 11–16: 1500×; Figs. 7–9: SEM, bar=3 µm; Fig. 10: 1100×; Fig. 17: 2000×.)

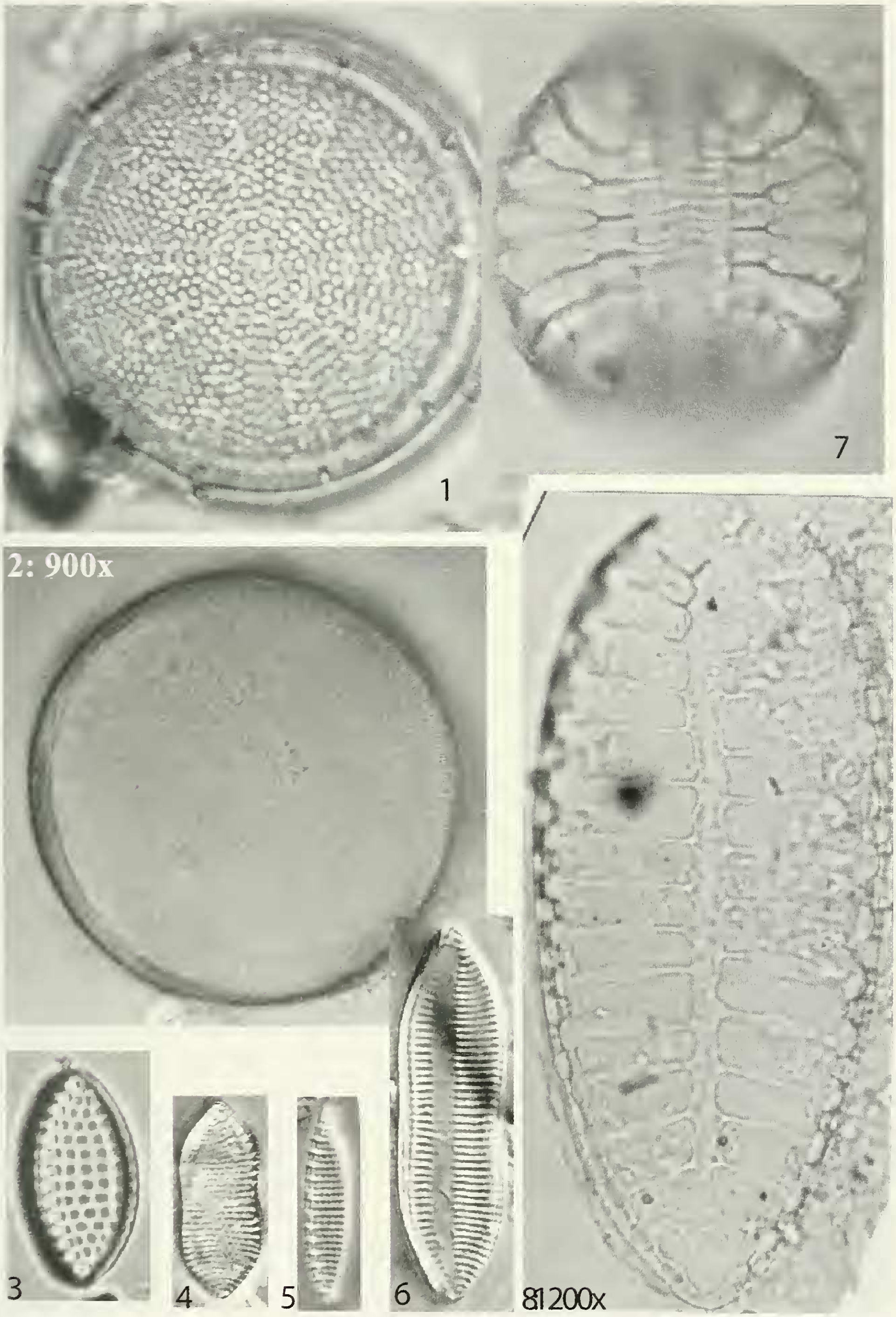

PLATE II. Fig. 1: *Actinocyclus* cf. *ochotensis* Jouse; Fig. 2: *A.* cf. *subtilis* (Gregory) Ralfs; (900x) Fig. 3: *Nitzschia granulata* Grunow; Fig. 4: *N. coarctata* Grunow; Fig. 5: *N. constricta* (Kützing) Ralfs; Fig. 6: *Campylodiscus* cf. *simulans* Gregory; Fig. 6: *Surirella* cf. *fluminensis* Grunow. (Figs. 1, 3–7: 1500×; Fig. 2: 900×; Fig. 8: 1200×.)

Campylodiscus cf. *simulans* Gregory (Plate 2: Fig. 7) was found in Butrinti and Saranda Bay. The morphology seems to be intermediate between that of *C. simulans* Gregory (Schmidt's Atlas: Tafel 17, Figs. 12–14) and *C. thuretii* var. *baldjikiana* Grunow (Plate 51, Figs. 16–21).

Surirella cf. *fluminensis* Grunow (Plate 2: Fig. 8) is a poorly known species. The morphology appears to be similar to that of the specimen drawn in Schmidt's Atlas (Plate 5: Fig. 6). Specimens were 44–62 µm long and 23–27 µm broad with 8 ribs/100 µm. The axial area was relatively narrow. This organisms were frequent in Karavasta and scarce in other Albanian lagoons.

Nitzschia reversa W. Smith was found to form blooms in Ceka lagoon (Lezha) (Plate 1: Fig. 17). It is characterised by sigmoid valve shape (35–95 µm long and 2.5–3.5 µm broad) and a very fine striation (not resolvable in LM). It was smaller and finer than the specimens from the type population characterized in Witkowski et al. (2000) or Proshkina-Lavrenko (1955).

Pseudonitzschia seriata Cleve (Plate 1: Fig. 15) was very abundant in Butrinti lagoon. During late spring and summer of 1987 it was observed to form a bloom (Miho 1994).

Diatoms: Ecological Approach

Guelorget and Perthuisot (1984) have proposed a biological zonation system for lagoons, based on their 'confinement', a hydrological parameter linked mainly to exchange/renewal of the water. It can be based on benthic communities, where each community characterizes one of the six defined zones. Therefore, each zone has its own specific richness, density, biomass, productivity (including phytoplankton), etc. Hence, based on the composition of the microalgae, such zonation could be drawn up, and as a consequence a diagnosis of the biological and economic potential of a lagoon could even be made. Here, some preliminary insights into biological zones that prevail in Albanian lagoons are presented, based on the algal assemblages.

Butrinti ranks among typical meromictic water bodies; therefore, optimum conditions for phytobenthos are to be found in some borderline locations, dominated by *Enteromorpha prolifera* (Miho 1994, 1996). The remaining part of the bottom is affected by anaerobic conditions, characterized by high rates of organic matter sedimentation and decomposition. Thus, the primary production is virtually due to the phytoplankton of the upper layers (5–7 m depth), which was dominated by one or two species of centric diatoms (often accounting for more than 90% of the primary producers). The seasonal pattern involved a very pronounced peak in spring (up to 44,000 cells/ml in March 1991) and a smaller one in the autumn. A phytoplankton decline, accompanied by a relative increase in peridinophyte abundance, was recorded in the summer.

Intensive growth of phytoplankton, mainly by the neritic forms of the centric diatoms mentioned, shows that the upper layers of Butrinti mainly belong to zone 3. According to Dutrieux and Guelorget (1988) this zone is characterized by limited impact of hydrodynamic conditions; the organic matter content increases in both sediment and water, although the overall living conditions remain good. It represents a habitat favourable for shellfish reproduction, as evidenced by profusion of *Mytilus galloprovincialis* everywhere in Butrinti. However, being permanently stratified with anoxic bottom waters, the lagoon poses a potential risk to aquaculture.

Centric diatoms were the most abundant in Orikumi (Miho and Dedej 1999). The phytoplankton structure seemed to be similar to that in Butrinti, but the cell density was much lower. However, the increase of peridinophytes was observed in summer as well. Taking the species composition into account, even Orikumi seems to represent predominantly zone 3, with similar features of surface waters in Butrinti, related to shellfish production. However, it is worth mentioning that the coastal wetland at Orikumi is exposed to one of the strongest human impacts among the Albanian lagoons. Its area was extremely reduced by land reclamation about 35 years ago. Consequently, its biological characteristics were significantly altered.

To obtain a complete zonation view for each lagoon a more detailed approach of their physico-chemical and biological features would be necessary. A small number of phytoplankton samples from Narta, a large and very shallow lagoon (the depth ranges from 0.3 to 1 m), contained a few species only. This water body is characterized by a very limited connection with the sea and slow water exchange, belonging mainly to zone 6. After Dutrieux and Guelorget (1988) it does not support intensive phytoplankton growth, and its use for intensive aquaculture is rather limited; therefore, the lagoon could be suitable for traditional fishing.

Pennate diatoms were most abundant in Karavasta. Unlike in other lagoons (Butrinti or Ceka), blooms or intensive growth of peridinophytes were not observed there. In agreement with Guelorget and Lefebvre (1993), zones 4 and 5 seem to prevail within the lagoon, characterised by a high productivity, mostly attributable to phytoplankton. Therefore, it may be used mainly in an extensive way for farming detritivorous fish species (e.g., mullet) or peneid shrimps (Dutrieux and Guelorget 1988). Similar characteristics seem to be typical of Patoku and Ceka (Lezha). As indicated by the diatom flora, dominated by centrics, Merxhani lagoon shows a relatively good water exchange with the sea, characteristic of zone 3.

During April-June 1987, an abnormal bloom of *Pseudonitzschia seriata* was observed in Butrinti, followed by a bloom of *Prorocentrum micans* and *P. minimum* (Miho 1994), both known to produce toxins (Hallegraeff 1995). Algal bloom was observed also in Ceka (Lezha; spring-summer 1992), where *Nitzschia* spp. or *Prorocentrum* spp. and *Gonyiaulax* spp. were dominant. This indicates conditions of stress, ensuing probably due to a combination of climate, the very limited water circulation in the lagoon and restricted water exchange with the sea. According to Marasovic (1989), the very high evaporation rate accompanied by increasing water temperature and salinity may contribute to the environmental stress as well. These critical conditions allow the presence of only a few species, with extremely dense growth.

Parameters important in evaluation of the trophic status and other ecological features of a habitat may include the diversity index (Shannon and Weawer 1949) and/or dominance index (McNaughton 1967). In Butrinti, the diversity index was higher in marine habitats (varying from 1.9 to 3.4 in the littoral zone) than within the lagoon (ranging from 0.6 to 2.5; Miho 1994, 1996). In lagoon habitats, contributions of the two dominant species were very high (up to 92.4 % in Butrinti) and showed a strong seaward decrease (27.8% in Armura or 30.3% in Saranda). Generally, even the number of species was higher in the littoral marine habitats than in the lagoons, where the water exchange was limited. Armura, Butrinti (northern part), Karavasta, and Merxhani were the most distinct habitats in terms of species richness and trophic status.

Concluding Remarks

Albanian coastal wetlands, exemplified by the habitats studied in Butrinti, Armura, Karavasta, Orikumi and Merxhani show a high diversity of diatoms. The species composition found in some lagoons provides evidence of relatively good water exchange with the sea and favourable conditions of the natural environment. Stress conditions were observed in some other localities. Algal blooms were sporadically observed in Butrinti and Ceka, especially during the summer. The blooms were formed by pennate diatoms, e.g., *Pseudonitzschia seriata* and *Nitzschia reversa*, and by a few peridinophytes some of which are known to produce neurotoxins. Highly stressing conditions seem to prevail for an extended period of time in Narta and Kenalla pond (Lezha). The eutrophic status and related stressing conditions there are probably the result of limited water exchange with the sea. Moreover, the Albanian coast and the wetlands continue to be endangered by tourism, urban and industrial wastewater pollution, etc.

Potentially, the Albanian coast is a valuable environmental asset, but there is an urgent need of responsible protection and management.

Taking appropriate measures in important and sensitive watershed areas will help to prevent damage to biodiversity and other natural values. Studies of the structure of diatom floras would provide additional information leading toward a better ecological approach of coastal ecosystems.

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Appendix

TABLE 1. Checklist of Diatoms Found in Albanian Coastal Wetlands

Key: A: Armura; B: Butrinti; C: Ceka; D: Durresi; K: Karavasta; Ke: Kenalla; L: Lalzi; Le: Lezha; M: Merxhani; N: Narta; O: Orikumi; P: Patoku; S: Saranda; Vl: Vlora; V: Viluni (see Fig. 1).
Note: The taxa labeled with 'Vl' were reproted by Protic (1907), 'D' and partly 'K' by Dedej (1994, 1995), 'A, B, C, L, Le, K, Ke, M, O, P, S, V' by Miho (1994, 1996), Miho and Dedej (1999), and Miho and Mitrushi (1999); data for unlabeled taxa are from the unpublished notes of A. Miho.

Bacillariophyceae: Centricae

Actinocyclus cf. *subtilis* (Gregory) Ralfs [S]
Actinocyclus ochotensis Jouse [A]
Actinocyclus octonarius Ehrenberg (= *A. ehrenbergii* Ralfs) [B]
Actinocyclus subtilis (Gregory) Ralfs [A, B, S]
Actinoptychus senarius (Ehrenberg)Ehrenberg [B]
Actinoptychus splendens (Shadbolt) Ralfs [M]
Amphitetras antediluviana Ehrenberg [B, K, O]
Asteromphalus heptactis (Brébisson) Ralfs [B, M]
Asteromphalus robustus Castracane [B]
Aulacoseira ambigua (Grunow) Simonsen [B]
Aulacoseira granulata (Ehrenberg) Simonsen [B, K]
Aulacoseira islandica (Mueller) Simonsen [L]
Bacteriastrum furcatum Shadbolt [B, Ke]
Bacteriastrium delicatulum Cleve [B; Ke]
Biddulphia pulchella Gray [A, B]
Cerataulina pelagica (Cleve) Hendey [K]
Cerataulina bergonii (Peragallo) Schuett [B, D]
Ceratulus turgidus (Ehrenberg) Ehrenberg [B, C, K, M, P]
Chaetoceros affinis Lauder [B]
Chaetoceros atlanticus Cleve [B, K]
Chaetoceros atlanticus var. *neapolitana* (Schroeder) Schuett [B, K, M]
Chaetoceros decipiens Cleve [B]
Chaetoceros densus Cleve [B, Le]
Chaetoceros diversus Cleve [B, D]
Chaetoceros insignis Proshkina-Lavrenko [D]
Chaetoceros lorenzianus Grunow [D]
Chaetoceros muelleri Lemmermann [Ke]
Chaetoceros peruvianus Brightwell [D]
Chaetoceros subtilis Cleve [B]
Chaetoceros teres Cleve [D]
Chaetoceros tortissimus Grunow [B]
Chaetoceros wighamii Brightwell [B]
Coscinodiscus cf. *curvatulus* Grunow var. *minor*[B]
Coscinodiscus nodulifer Schmidt [B, K]
Cyclotella aff. *choctawhatcheeana* Prasad [B, O, K]
Cyclotella cf. *hustedti* Jurilj [B]
Cyclotella meneghiniana Kützing [B, Le, O, D]
Cyclotella ocellata Pantocsek [B, O]
Cyclotella radiosa (Grunow) Lemmermann [B, K]
Cyclotella striata (Kützing) Grunow [B, P]
Cymatosira lorenziana Grunow [S]
Dactyliosolen blavyanus (Peragallo) Hasle [B, D, M, O]
Dactyliosolen fragilissimus (Bergon) Hasle [B, D, K, M, O]
Guinardia flaccida (Castracane) Peragallo [K]
Guinardia striata (Stolterfoth) Hasle (=*Rhizosolenia stolterfothii* Peragallo) [B]
Hemiaulus hauckii Grunow [B, D, M]
Hyalodiscus radiatus (O'Meara) Grunow [B, D, K, Le, O, P, V]
Hyalodiscus scoticus (Kützing) Grunow [B]
Leptocylindrus adriaticus Schroeder [B, K, O]
Leptocylindrus minimus Grunow [B]
Melosira moniliformis (Mueller) Agardh var. *moniliformis* [B, Le, M, O, P, V]
Melosira nummuloides Agardh [B, K, Ke, M, O, P]
Melosira sol (Ehrenberg) Kützing [S]
Melosira varians Agardh [B, K, Vl]
Odontella aurita (Lyngbye) Brébisson [B, K]
Odontella mobiliensis (Bailey) Grunow [B, K]
Porosira cf. *pseudodenticula* (Hustedt) Jouse [A]
Proboscia alata (Brightwell) Sundstroem (=*Rhizosolenia alata* Brightwell) [B, D, K, M, O]
Pseudosolenia calcar-avis (Schultze) Sundstroem [B, D]
Rhizosolenia imbricata var. *shrubsolei* (Cleve) Schroeder [B]
Skeletonema costatum (Greville) Cleve [K]
Thalassiosira lacustris Grunow var. *lacustris* [B, K]
Triceratium favus Ehrenberg [B]
Triceratium reticulum Ehrenberg [S]

Bacillariophyceae: Pennatae

Achnanthes brevipes Agardh var. *brevipes* [B, K]
Achnanthes brevipes var. *angustata* (Greville) Cleve [B, P]
Achnanthes brevipes var. *intermedia* (Kützing) Cleve [B, K,M, O, P, V]
Achnanthes cf. *groenlandica* (Cleve) Grunow [S]
Achnanthes delicatula (Kützing) Grunow var. *delicatula* [B]
Achnanthes exigua Grunow [B]
Achnanthes exilis Kützing [Vl]
Achnanthes hungarica Grunow [K]
Achnanthes lanceolata (Brébisson) Grunow agg. [B]
Achnanthes longipes Agardh [B, K, M, P, V]
Achnanthes minutissima Kützing [B, D, K, M, N, Vl]
Achnanthes separata Hustedt [A, S]
Achnathes parvula Kützing [S]
Adlafia minuscula Grunow (Lange-Bertalot) [Le]
Amphipleura pellucida (Kützing) Kützing [B, D, K, Vl]
Amphora angularis Gregory [Vl]
Amphora angularis var. *lyrata* Van Heurck [Vl]
Amphora arenaria Donkin [A]
Amphora *cf.* granulata *Gregory [S]*
Amphora *cf.* tomiakae *Witk., Lange-Bert. and Metz. [B, S]*

Amphora coffeaeformis (Agardh) Kützing [B, C, K, O, P]
Amphora commutata Grunow [VI]
Amphora costata W. Smith [S]
Amphora holsatica Hustedt [B, D, Le, O, P]
Amphora inflata Grunow [K]
Amphora kolbei Aleem [A, S]
Amphora laevis Gregory [K]
Amphora laevissima Gregory [S]
Amphora lineolata Ehrenberg [B, K, Ke, M, VI]
Amphora lybica Ehrenberg [B, D, K, O]
Amphora marina (W. Smith) Van Heurck [A, B]
Amphora ovalis (Kützing) Kützing [K, Le, O, VI]
Amphora ovalis var. *affinis* Kützing [VI]
Amphora pediculus (Kützing) Grunow [B, K, Le, VI]
Amphora pseudohyalina Simonsen [S]
Amphora robusta Gregory [B, K, Le, P]
Amphora salina W. Smith [VI]
Aneumastus tusculus (Ehrenberg) Mann [Le, VI]
Brachysira serians (Brébisson) Round and D.G. Mann [VI]
Ardissonia crystallina (Agardh) Grunow (Agardh) Kützing [A, B]
Ardissonia fulgens (Greville) Grunow [B, K, Le, P, S]
Asterionellopsis glacialis (Castracane) Round [K]
Bacillaria cf. *socialis* (Gregory) Ralfs [S]
Bacillaria paradoxa Gmelin [B, D, K, Le, P]
Berkeleya scopulorum (Brébisson) Cox [S]
Caloneis amphisbaena (Bory) Cleve [B, K]
Caloneis amphisbaena var. *subsalina* Van Heurck [VI]
Caloneis bicuneata (Grunow) Wolle [B]
Caloneis liber (W. Smith) Hendey [B]
Caloneis silicula (Ehrenberg) Cleve agg. [B, D, K, VI]
Caloneis westii (W. Smith) Hendey [B, K, P]
Campylodiscus bicostatus W. Smith [B, K, O]
Campylodiscus cf. *simulans* Gregory
Campylodiscus clypeus Ehrenberg [B, K, O, VI]
Campylodiscus echeneis Ehrenberg [B, K, Le, P]
Campylodiscus levanderi Hustedt [B, K]
Campylosira cymbelliformis (Schmidt) Grunow [VI]
Cavinula cocconeiformis (Gregory) Mann and Stickle [B, K]
Cocconeis costata Gregory [B, K, O]
Cocconeis guttata Hustedt [S]
Cocconeis molesta Kützing [K, Le]
Cocconeis neodiminuta Krammer [B, K, O]
Cocconeis pediculus Ehrenberg [B, O, VI]
Cocconeis placentula (Ehrenberg) Hustedt agg. [VI]
Cocconeis placentula Ehrenberg var. *placentula* [B, K, O]
Cocconeis placentula var. *euglypta* (Ehrenberg) Cleve [B, K, Le, P]
Cocconeis placentula var. *lineata* (Ehrenberg) Van Heurck [Le]
Cocconeis scutellum Ehrenberg [B, K, Le, P]
Cocconeis pseudomarginata Gregory [B, A]
Craticula cuspidata (Kützing) Mann [B, D, K, O]
Craticula halophila (Grunow) D.G. Mann [B, D, K, Le, V]
Ctenophora pulchella (Ralfs ex Kützing) Williams and Round (=*Fragilaria pulchella* (Ralfs) Lange-Bertalot [B, Le, K, O]
Cylindrotheca cf. *gracilis* (Brébisson) Grunow [B, K, P]
Cylindrotheca closterium (Ehrenberg) Reimann and Lewin (=*Nitzschia closterium* (Ehrenberg) W. Smith) [B, D, K, M, P]
Cymatopleura elliptica (Brébisson) W. Smith [B, VI]
Cymatopleura solea (Brébisson) W. Smith [B, VI]
Cymbella affinis Kützing agg. [B, K, O, P]
Cymbella ampicephala Naegeli var. *amphicephala* [B]
Cymbella aspera (Ehrenberg) Peragallo [VI]
Cymbella cistula (Ehrenberg) Kirchner agg. [VI]
Cymbella cymbiformis Agardh var. *cymbiformis* [VI]
Cymbella delicatula Kützing [VI]
Cymbella ehrenbergii Kützing [VI]
Cymbella helvetica Kützing [B, P, VI]
Cymbella lanceolata (Ehrenberg) Kirchner [VI]
Cymbella pusilla Grunow [VI]
Cymbella tumida (Brébisson) Van Heurck [K, P, VI]
Cymbella turgida (Gregory) Cleve [B]
Delphineis cf. *livingstonii* Prasad [S]
Denticula tenuis Kützing [VI]
Diatoma anceps (Ehrenberg) Kirchner [VI]
Diatoma ehrenbergi Kützing [Le]
Diatoma hyemalis (Rith) Heiberg [VI]
Diatoma tenuis Agardh (=*D. elongatum* (Lyngbye) Agardh) [O]
Diatoma vulgaris Bory var. *vulgaris* [B, VI]
Diatoma vulgaris var. *tenuis* Van Heurck [VI]
Dimerogramma minor (Gregory) Ralfs [S]
Diploneis cf. *interrupta* (Kützing) Cleve [S]
Diploneis cf. *littoralis* (Donkin) Cleve [B, S]
Diploneis cf. *mirabilis* Koenig [A]
Diploneis cf. *smithii* var. *dilatata* (Peragallo) Terry
Diploneis didyma (Ehrenberg) Cleve [B, Le, K, O, P]
Diploneis domblittensis Cleve [B]
Diploneis elliptica (Kützing) Cleve (=*Navicula elliptica* Kützing) [VI]
Diploneis marginestriata Hustedt [B]
Diploneis oblongella (Naegeli) Cleve-Euler [B]
Diploneis ovalis (Hilse) Cleve [B, Ke]
Diploneis smithii var. *pumila* (Grunow) Hustedt [B, K, P]
Diploneis subovalis Cleve [B, M]
Diploneis vetula (Schmidt) Cleve [A]
Dploneis subcincta (Schmidt) Cleve [B]
Encyonema caespitosum (Kützing) Grunow [VI]
Encyonema prostratum (Berkeley) Cleve [VI]
Encyonema ventricosum Kützing [B, VI]
Encyonopsis minuta Krammer and Reichardt [S]
Entomoneis paludosa (W. Smith) Reimer [B, K, Le, O, P]
Entomoneis alata (Ehrenberg) Ehrenberg [B, S]
Epithemia aduata (Kützing) Brébisson [B, K, O, VI]
Epithemia smithii Carruthers [B]
Epithemia sorex Kützing [B, K, O, VI]
Epithemia turgida (Ehrenberg) Kützing [VI]
Epithemia turgida var. *granulata* (Ehrenberg) Grunow [Le]
Eunotia arcus Ehrenberg [VI]
Eunotia cf. *exigua* (Brébisson) Rabenhorst [Le]
Eunotia flexuosa (Brébisson) Kützing [VI]
Eunotia pectinalis (Dillwyn) Rabenhorst [VI]
Eunotia praerupta Ehrenberg [B, K, O]
Fallacia versicolor (Grunow) Mann [S]

Fragilaria affinis Kützing [K]
Fragilaria capucina Grunow var. *capucina* [Vl]
Fragilaria capucina var. *perminuta* (Grunow) Lange-Bertalot [B]
Fragilaria crotonensis Kitton [B, D, K]
Fragilaria dilatata (Brébisson) Lange-Bertalot (=*F. capitata* (Ehrenberg) Lange-Bertalot) [Vl]
Fragilaria fasciculata (Agardh) Lange-Bertalot [B, K, Le, O, P, V]
Fragilaria investiens (W. Smith) A. Cleve [B]
Fragilaria laevissima Oestrup [B, S]
Fragilaria pinnata Ehrenberg gr. [B, K, O, P]
Fragilaria ulna (Nitzsch) Lange-Bertalot agg. [B, Le, O, P]
Fragilaria ulna (*Synedra*) var. *longissima* Van Heurck [Vl]
Fragilaria ulna (*Synedra*) var. *oxyrhynchus* (Kützing) Van Heurck [Vl]
Fragilaria (*Synedra*) *ulna* var. *subaequalis* Grunow [Vl]
Fragilaria virescens Ralfs [Vl]
Frustulia cf. *weinholdii* Hustedt [B]
Gomphonema acuminatum Ehrenberg [Le, Vl]
Gomphonema angustatum (Kützing) Rabenhorst [Vl]
Gomphonema angustum Agardh [Vl]
Gomphonema constrictum Ehrenberg [Vl]
Gomphonema gracile Ehrenberg [Le]
Gomphonema minutum (Agardh) Agardh agg. [B, K, O]
Gomphonema olivaceum (Horn.) Brébisson var. *olivaceum* [B, K, O, Vl]
Gomphonema olivaceum var. *calcareum* (Cleve) Cleve [B, K, O]
Gomphonema olivaceum var. *staurophorum* Pantocsek [B, D, K]
Gomphonema parvulum (Kützing) Grunow [Le, Vl]
Gomphonema pseudotenellum Lange-Bertalot [Le]
Gomphonema truncatum Ehrenberg [B, D, K, Le, O]
Grammatophora angulosa Ehrenberg var. *angulosa* [B, Le]
Grammatophora macilenta W. Smith [B, K, V]
Grammatophora oceanica (Ehrenberg) Grunow var. *oceanica* [B, K, Le, N, O, P, V]
Gyrosigma acuminatum (Kützing) Rabenhorst var. *acuminatum* [B, K, Le, N, P, V]
Gyrosigma attenuatum (Kützing) Rabenhorst [B, K, O]
Gyrosigma arcuatum (Donkin) Sterrenburg
Gyrosigma balticum (Ehrenberg) Rabenhorst [B, K, Le, N, O, P, V]
Gyrosigma cf. *obscurum* (W. Smith) Griffith and Henfrey [B]
Gyrosigma cf. *peisonis* (Grunow) Hustedt [Le]
Gyrosigma cf. *wansbecki* (Donkin) Cleve [Le]
Gyrosigma compactum (Grev.) Cleve [B, S]
Gyrosigma fasciola (Ehrenberg) Griff. and Henf. [B, K, Le, N, O, P, V]
Gyrosigma strigilis (W. Smith) Cleve [B, K, Le, P]
Hantzschia amphioxys (Ehrenberg) Grunow [B, Vl]
Hantzschia amphioxys fo. *capitata* Hustedt [B]
Licmophora cf. *grandis* (Kützing) Grunow [B, K]
Licmophora cf. *hyaline* Kützing [B, K]
Licmophora ehernberghii (Kützing) Grunow [B, K]
Licmophora flabellata var. *splendida* W. Smith [K]
Licmophora remulus Grunow [B, K, Le, N, O, P, V]
Licmophora dalmatica (Kützing) Grunow [Vl]
Licmophora flabellata (Carmichael) Agardh
Licmophora gracilis (Ehrenberg) Grunow
Licmophora paradoxa (Lyngbye) Agardh [A, S]
Lyrella amphoroides D.G. Mann [S]
Lyrella cf. *clavata* (Gregory) D.G. Mann [M]
Lyrella lyra (Ehrenberg) Karayeva [B, K]
Lyrella spectabilis (Gregory) D.G. Mann [A, S]
Lyrella sulcifera (Hustedt) Witkowski [B, K, O, P, Le]
Mastogloia angulata Lewis [B, K, O, P, Le]
Mastogloia binotata (Grunow) Cleve [B]
Mastogloia braunii Grunow [B, K, O, Vl]
Mastogloia cf. *adriatica* Voigt [B]
Mastogloia cf. *baldjikiana* Grunow [B, K]
Mastogloia cf. *biocellata* (Grunow) Nov. and Muft. [B]
Mastogloia cf. *labuensis* Cleve [B]
Mastogloia cf. *recta* Husted [B]
Mastogloia crucicula (Grunow) Cleve [B, K, O]
Mastogloia cuneata (Meister) Simonsen [B]
Mastogloia dansei Thwaites [Vl]
Mastogloia grunowii A. Schmidt [B]
Mastogloia ignorata Hustedt [B]
Mastogloia lanceolata Thwaites [A]
Mastogloia laterostrata Hustedt [B]
Mastogloia ovalis A. Schmidt [A]
Mastogloia paradoxa Grunow [B]
Mastogloia pseudoexigua Cholonky [B]
Mastogloia pseudolatecostata Yohn and Gibson [A]
Mastogloia pumila (Grunow) Cleve [B]
Mastogloia pusilla (Grunow) Cleve [B]
Mastogloia robusta Hustedt [B]
Mastogloia smithii Thwaites var. *smithii* [B]
Mastogloia smithii var. *lacustris* Grunow [B, D, K, O]
Mastogloia splendida (Gregory) Cleve [B]
Mastogloia vasta Hustedt [B]
Navicula agnita Hustedt [A]
Navicula arenaria Donkin [B, S]
Navicula cf. *besarensis* Giffen [S]
Navicula cf. *heimansii* Van Dam et Kooyman [B]
Navicula cf. *indulgens* Simonsen [B]
Navicula cf. *johanrossii* Giffen [S]
Navicula cf. *subhamulata* Grunow [Le]
Navicula cincta (Ehrenberg) Kützing [Vl]
Navicula cluthensis Gregory var. *cluthensis* [P, V]
Navicula cryptocephala Kützing [D, K, Vl]
Navicula cryptotenelloides Lange-Bertalot [B]
Navicula dealpina Lange-Bertalot [Vl]
Navicula digitoradiata (Gregory) Ralfs [Vl]
Navicula distans (W. Smith) Ralfs [Vl]
Navicula duerrenbergiana Hustedt [B]
Navicula erifuga Lange-Bertalot [A]
Navicula granulata Bailey [C, Ke, V]
Navicula gregaria Donkin [B, S, V]
Navicula integra W. Smith [Vl]
Navicula monilifera Cleve [B, K]
Navicula oblonga (Kützing) Kützing [B, K, O, Vl]
Navicula pavillardii Hustedt [B, C]
Navicula peregrina (Ehrenberg) Kützing [Vl]
Navicula perminuta Grunow [B]

Navicula perrhombus Hustedt [B]
Navicula phyllepta Kützing [B, K, O, P, Le]
Navicula phylleptosoma Lange-Bertalot [B]
Navicula pseudosilicula Hustedt [Vl]
Navicula radiosa Kützing [V, Vl]
Navicula recens (Lange-Bertalot) Lange-Bertalot [Le]
Navicula rhynchocephala Kützing [B, Vl]
Navicula rolandii Lange-Bert. and Witk. [O]
Navicula salinarum Grunow [B, K, O, Vl]
Navicula salinicola Hustedt [A, B, S]
Navicula ternes Ehrenberg [Vl]
Navicula tripunctata (Mueller) Bory [B, Le]
Navicula veneta Kützing [B, K]
Navicula viridula (Kützing) Ehrenberg [Vl]
Neidium iridis var. *affinis* Ehrenberg [Vl]
Neidium iridis var. *amphirhynchus* Ehrenberg [Vl]
Nitzschia acicularioides Hustedt [S]
Nitzschia amphibia Grunow [B]
Nitzschia angularis W. Smith [A, S]
Nitzschia cf. *filiformis* var. *conferta* [Le]
Nitzschia cf. *graeffii* Grunow [S]
Nitzschia cf. *plana* W. Smith [B, S]
Nitzschia cf. *prolongata* Hustedt [B]
Nitzschia cf. *splendida* Kützing [B, K]
Nitzschia capitellata Hustedt [B, K, O]
Nitzschia circumsuta (Bailey) Grunow [B, D, K, P, Le, V]
Nitzschia clausii Hantzsch [B]
Nitzschia coarctata Grunow [B, K, O, P, Le]
Nitzschia communis Rabenhorst [Vl]
Nitzschia commutata Grunow [Vl]
Nitzschia compressa (Bailey) Boyer var. *compressa* [B, D, K, O, P, Le]
Nitzschia constricta (Kützing) Ralfs [B, D, K, O, P, Le]
Nitzschia denticula Grunow (=*Denticula Kützingii* Grunow) [B, K, O, P]
Nitzschia dissipata (Kützing) Grunow [B]
Nitzschia dissipata var. *media* (Hantzsch) Grunow [Le]
Nitzschia distans var. *tumescens* Gregory [K]
Nitzschia filiformis (W. Smith) Hustedt [A, B, S]
Nitzschia flexoides Geitler [B]
Nitzschia fossilis Grunow [Le]
Nitzschia granulata Grunow [B, Le]
Nitzschia hungarica Grunow [Vl]
Nitzschia incospicua Grunow [B]
Nitzschia lacuum Lange-Bertalot [A, B, S]
Nitzschia lanceola var. *minutula* Grunow [B]
Nitzschia lanceolata W. Smith [B]
Nitzschia linearis (Agardh) W. Smith [Vl]
Nitzschia littoralis Grunow [S]
Nitzschia longissima (Brébisson) Ralfs [B, D, K, Le, V]
Nitzschia macilenta Gregory [B]
Nitzschia microcephala Grunow [Le]
Nitzschia palea (Kützing) W. Smith [B, K, Le, Vl]
Nitzschia panduriformis Gregory [A]
Nitzschia pararostrata (Lange-Bertalot) Lange-Bertalot [B]
Nitzschia recta Hantzsch [B]
Nitzschia reversa W. Smith [Le, O]
Nitzschia scalpelliformis Grunow [V]
Nitzschia sigma (Kützing) W. Smith [B, K, Le, Vl]
Nitzschia sigma var. *sigmatiella* Grunow [D, K, Le, P, V]
Nitzschia sigmoidea (Nitzsch) W. Smith [Vl]
Nitzschia paleacea (Grunow) Grunow [Vl]
Nitzschia vitrea var. *salinarum* Grunow [Vl]
Opephora mutabilis (Grunow) Sabbe and Vyverman [B]
Parlibellus berkeleyi (Kützing) Cox [A, S]
Parlibellus cruciculoides (Brock.) Witk., Lange-Bert. and Metzeltin [S]
Parlibellus protracta (Grunow) Witk., Lange-Bert. and Metzeltin [A, Le, S]
Parlibellus rhombicula (Hustedt) Witk., Lange-Bert. and Metzeltin [S]
Petroneis humerosa (Brébisson) D.G. Mann [B, K, M]
Pinnularia appendiculata (Agradh) Cleve [Vl]
Pinnularia gibba Ehrenberg [Vl]
Pinnularia legumen (Ehrenberg) Ehrenberg [Vl]
Pinnularia major (Kützing) Rabenhorst [Vl]
Pinnularia microstauron var. *brebissonii* (Kützing) Mayer [Vl]
Pinnularia nobilis (Ehrenberg) Ehrenberg [Vl]
Pinnularia pulchra Oestrup Ehrenberg) [Vl]
Pinnularia tabellaria Ehrenberg [Vl]
Placoneis elginensis (Gregory) Cox [Vl]
Placoneis gastrum var. *signata* (Hustedt) [B, K]
Plagiotropis gibberula Grunow [S]
Plagiotropis lepidoptera (Gregory) Kuntze [A, B, V]
Pleurosigma angulatum (Quekett) W. Smith [B, K, Le, O, P, V]
Pleurosigma cf. *rostratum* Hustedt [M]
Pleurosigma elongatum W. Smith [B, D, K, Le, O, P, V]
Pleurosigma formosum Peragallo [B, K, Le, O, P, V]
Pleurosigma salinarum Grunow [S, Le]
Pseudonitzschia delicatissima (Cleve) Peragallo [D]
Pseudonitzschia seriata (Cleve) Peragallo [B, K, Le, O, P, V]
Pterodictyon gemma (Ehrenberg) D.G. Mann [B, K, P]
Rhabdonema adriaticum Kützing [B, K, Le, O, P, V]
Rhoicosphenia abbreviata (Agardh) Lange-Bertalot [B, Vl]
Rhoicosphenia marina (W. Smith) M. Schmidt [B]
Rhopalodia acuminata Krammer [A, S]
Rhopalodia brebissonii Krammer [B]
Rhopalodia cf. *constricta* (W. Smith) Krammer [A]
Rhopalodia cf. *gibberula* (Ehrenberg) Mueller [B, K]
Rhopalodia gibba (Ehrenberg) Mueller [B, K, Le, O, P, Vl]
Rhopalodia gibba var. *minuta* Krammer [A, S]
Rhopalodia musculus (Kützing) Mueller [B, D, K, Le, O, P, V]
Sellaphora bacillum (Ehrenberg) Mereschkowsky [Vl]
Sellaphora seminulum (Grunow) D.G. Mann [Vl]
Seminavis basilica Danielidis and D.G. Mann [A, B, S]
Stauroneis acuta W. Smith [Vl]
Stauroneis anceps Ehrenberg [Vl]
Stauroneis gregori Ralfs [Vl]
Stauroneis phoenicenteron Ehrenberg [Vl]
Stauroneis salina W. Smith [Vl]
Staurosira brevistriata Grunow (=*Fragilaria brevistriata* Grunow, *Pseudostaurosira brevistriata* (Grunow) Williams and Round) [B, O]
Staurosira construens Ehrenberg (=*Fragilaria construens*

(Ehrenberg) Grunow) [B, S]
Striatella unipunctata (Lyngbye) Agardh [B, K, Le, O, P, V]
Surirella biseriata Brébisson [Vl]
Surirella brebissonii Krammer and Lange-Bertalot [B, K, O]
Surirella cf. *fluminensis* Grunow [B, K, M, P]
Surirella cf. *scalaris* Giffen [A, S]
Surirella fastuosa (Ehrenberg) Kützing [B, K, Le, O, P, V]
Surirella minuta Brebisson [Vl]
Surirella ovalis Brébisson [B, K, O, Vl]
Surirella spiralis Kützing [K, Vl]
Surirella splendida (Ehrenberg) Kützing [Vl]
Surirella striatula Turpin [B, C, K, O, P]
Synedra tabulata (Agardh) Kützing var. *tabulata* [B, K, Le]
Synedra undulata (Bailey) Gregory (=*Toxarium undulatum* Bailey) [B, Le, O]
Tabellaria fenestrata (Lyngbye) Kützing [Vl]
Tabellaria flocculosa (Roth) Kützing [Vl]
Thalassionema nitzschioides (Grunow) Grunow [B, D, K, Le, O]
Trachyneis aspera (Ehrenberg) Cleve [A]